CLAIMS

1. A control circuit for an actuator, comprising:

an analog central pattern generator circuit structured to generate a sine wave control signal at an output; and

an analog multi-vibrator circuit having an input coupled to the output of the central pattern generator and an output configured to be coupled to the actuator, the multi-vibrator circuit structured to generate a sine-variable rectangular wave signal in response to the control signal from the central pattern generator to drive the servo in a sine movement pattern.

2. The circuit of claim 1, wherein the analog multi-vibrator circuit comprises:

a first transistor having a control terminal coupled to an input, a first terminal coupled to a voltage source and a second terminal;

a second transistor having a control terminal coupled to the second terminal of the first transistor, a first terminal coupled to the voltage source and to an output, and a second terminal coupled to a reference voltage; and

a third transistor having a control terminal coupled to the output and to the voltage source, a first terminal coupled to the voltage source, and a second terminal coupled to the reference voltage.

3. A basic motor neuron circuit, comprising:

a first transistor having a control terminal coupled to an input, a first terminal coupled to a voltage source and a second terminal;

a second transistor having a control terminal coupled to the second terminal of the first transistor, a first terminal coupled to the voltage source and to an output, and a second terminal coupled to a reference voltage; and

a third transistor having a control terminal coupled to the output and to the voltage source, a first terminal coupled to the voltage source, and a second terminal coupled to the reference voltage.

4. The circuit of claim 3, further comprising a first capacitor coupled between the control terminal of the third transistor and the output, and a second capacitor coupled between the first terminal of the third transistor and the control terminal of the second transistor, the first and second capacitors configured to control timing for the circuit.

5. The circuit of claim 3, further comprising a first resistor and a second resistor coupled in series between the control terminal of the second transistor and the voltage source and configured to control a pulse width of a pulse signal generated on the output.

6. A robotic machine, comprising:

at least one movable component coupled to a servo that generates movement of the component;

a control circuit coupled to the servo for controlling actuation of the servo, the control circuit comprising:

a first transistor having a control terminal coupled to an input, a first terminal coupled to a voltage source and a second terminal;

a second transistor having a control terminal coupled to the second terminal of the first transistor, a first terminal coupled to the voltage source and to an output, and a second terminal coupled to a reference voltage; and

a third transistor having a control terminal coupled to the output and to the voltage source, a first terminal coupled to the voltage source, and a second terminal coupled to the reference voltage.

7. The machine of claim 6, further comprising a first capacitor coupled between the control terminal of the third transistor and the output, and a second capacitor coupled between the first terminal of the third transistor and the control terminal of the second transistor, the first and second capacitors configured to control timing for the circuit.

8. The machine of claim 6, further comprising a first resistor and a second resistor coupled in series between the control terminal of the second transistor and the voltage source and configured to control a pulse width of a pulse signal generated on the output.

9. A synthetic nervous system for robotic locomotion, comprising:

a central pattern generator having a pair of phase-coupled sine wave oscillators generating at least two output signals;

at least one motor neuron circuit coupled to the central pattern generator to receive at least one output therefrom; and

at least one servo coupled to the motor neuron circuit to receive an actuation signal therefrom.

10. The system of claim 9, further comprising one or more of an amplitude circuit, a DC offset circuit, a frequency generator circuit, and a variable phase circuit coupled to the central pattern generator and the motor neuron circuit for controlling amplitude, offset, frequency, and phase operation of the motor neuron circuit.

11. A synthetic nervous system for robotic locomotion, comprising:

a motor neuron circuit having first and second transistors coupled together to function as a multi-vibrator, a third transistor configured as a

voltage-variable resistor providing input to the motor neuron circuit, and an output on which is generated a pulse train signal providing input to the motor neuron circuit, and an output on which is generated a pulse train signal responsive to an input signal.

12. The system of claim 11, further comprising a central pattern generator having a master section that includes a master transistor having a first terminal coupled to a master output and a voltage source, a control, coupled to the voltage source, and a second terminal coupled to a master timing circuit having a master timing output coupled to the control terminal; and

a slave section coupled to the master section and including a slave resistor having a control terminal coupled to the voltage source and to the master output, a first terminal coupled to a slave output and the voltage source, and a second terminal coupled to a slave timing circuit having a slave timing output coupled to the control terminal of the slave transistor.

13. The system of claim 12, wherein the transistors comprise bipolar transistors.

14. The system of claim 12, wherein the central pattern generator comprises a resistor coupled between the master output and the slave output.

15. The system of claim 12, wherein the master and slave timing circuits each comprise an RC network.

16. The system of claim 12, further comprising a voltage-controlled resistive circuit coupled to the RC network of the master timing circuit to modulate an output frequency of the central pattern generator.

17. The system of claim 16, wherein the voltage-controlled resistive circuit comprises a first transistor having a control terminal coupled to the voltage source, a first terminal coupled to the voltage source and to an output, and to frequency modulate an output of the central pattern generator.